

Father Athanasius Kircher, S.J.

MASTER OF AN HUNDRED ARTS

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THE roll-call of men of science in the seventeenth century is long and impressive. The names of William Harvey, John Kepler, Francis Bacon, Galileo Galilei, Robert Boyle, René Descartes and Isaac Newton catch the eye as one reads down the list. These are the men who did so much to bring modern science to birth. They were men of genius and their glory has not faded in the last three centuries, though science in its advance has made obsolete portions of their work. Biographies of Boyle, Bacon, Newton and the others have been numerous ; their works have been reprinted and re-edited ; and in histories of science it is they who receive the greatest attention. This is only to be expected for it is the fame of the masters that first attracts the historian ; and the history of science is as yet in its infancy.

The full story of the scientific revolution in the seventeenth century has not yet been written ; it will not be completed until the contribution of the lesser as well as of the greater scientists has been studied and analysed. Until we know more about these men who were often the real pioneers of the revolution, but whose achievements have been eclipsed by the brilliance of others ; until the work of Hooke, Huygens, Gassendi, Sanctorius, Mersenne, Stensen, and of other little-known investigators has been properly assessed, the picture will remain a mere outline sketch.

Much has been done, and is being done in this regard and the findings have been rewarding and illuminating. But there is one group of seventeenth century scientists whose works and achievements remain neglected, and whose names seldom appear in histories of science. These are the Jesuit scientists, in their day highly honoured, who did so much to stimulate the birth of our present-day science. Few of their works have been re-edited ; seldom have critical examinations of their discoveries been attempted, yet these were men who, as Francis Bacon wrote, "partly in themselves, and partly by the emulation and provocation of their example, have much quickened and strengthened the state of learning"¹. Boyle, who displayed a close acquaintance with the works of "these eminent scholars . . . of the most learned order of the Jesuits . . . divers of whom for their eminence in mathematicks

¹ Bacon, Francis : *The Advancement of learning*, Book I, p. 15 in the 1843 edition of the *Works of Lord Bacon*, London.

and other learnings I much esteem"¹, refers to "Clavius, and divers others (who) have as prosperously addicted themselves to mathematicks as to divinity. And as to physics, not only Scheiner, Aquilonius, Kircher, Schottus, Zucchius and others have very laudably cultivated the optical as well as other parts of philosophy ; but Ricciolus himself is not only a divine, but a professor of divinity"².

To-day these Jesuit scientist-divines are hardly remembered. They are not, as Boyle felt they should be, ranked with Galileo, Huygens, Descartes, Kepler and Pascal. The work of Clavius in undertaking the reform of the calendar for Pope Gregory XIII, the researches of Scheiner and Aquilonius on light, of Ricciolus on problems of astronomy, of Schottus on hydraulics, and of Kircher on subjects ranging from harmonics and acoustics to chemistry and medicine, played a significant part in the early scientific revolution. Only detailed and critical study will reveal the true value of these contributions.

Athanasius Kircher seems to hold the most honourable place among these scientists of the Society of Jesus. It is not for the brilliance of his intellect, nor for the actual value of his achievements (Clavius and Scheiner did work of far more permanent value) but for the universality of his learning and for his far-reaching influence among scientists of his day, that he merits this ranking. Not alone does Boyle quote frequently and with much deference from Kircher's works, but his ideas find their place in the writings of René Descartes, Robert Hooke, Nicholas Stensen, Gottfried Leibnitz and many other scientists and philosophers of the seventeenth century. Catholics and anti-catholics referred to his works, not always with the approval Boyle manifested, but in each case showing the international influence of this Jesuit.

Kircher's life as a scientist spanned the period from the death of Francis Bacon, 1626, to what has been described as "one of the greatest decades, if not the very climax, of the scientific revolution"³—the decade in which Isaac Newton published his *Principia* (1687). Kircher was a scholastic, an ardent Aristotelian ; he was also a keen experimenter, fully open to modern ideas and progress. He stands as a link between medieval and modern science, quick to accept or to criticize what he found worthy of praise or blame in the science of the two periods. His own investigations were valuable and assisted others to make progress ; but his main success seems to have been as a collector of scientific facts and materials, an encyclopaedist. It was in thus facilitating a wide diffusion of ancient and modern knowledge, in stimulating thought and discussion by his vast collections of scientific information, that Kircher deserves a place among the "fathers" of modern science.

¹ Boyle, R. : *Defence of the Doctrine touching the Spring and Weight of Air*, in Vol. I, p. 120 of *Works of the Hon. Robert Boyle*, ed. Birch, London, 1773.

² Boyle, R. : *The Excellence of Theology in Works*, Vol. IV, p. 62.

³ Butterfield, H. : *The Origins of Modern Science*, p. 138, London, 1951.

It is true that this has not always been the view expressed on his life and labours. Some would have us believe that his influence on his contemporaries was nil¹. Let his life and works refute this accusation.

"I was born" wrote Kircher in his autobiography², "at three o'clock in the morning on the second day of May, the feast of St Athanasius, 1602 in Geysa, a town three hours journey distant from Fulda. It was a year of general calamity in the world". The Germany into which he was born was indeed a country of calamity, where the political and religious tensions that finally led to the Thirty Years War were causing unrest and hatred and bloodshed. John Kircher, Athanasius's father, a loyal and devoted Catholic and a distinguished scholar, had already suffered much for his faith at the hands of the heretics. A lay doctor of divinity and former professor of theology at Seiligenstadt, he had been appointed councillor to the Prince-Abbot of Fulda, Balthasar of Dermbach. However the Prince-Abbot had been driven into exile by the heretics and John Kircher, expelled from his office, had retired to Geysa and there devoted himself to study and to the education of his children. Athanasius grew up in a scholarly atmosphere and was early introduced by his father to the study of the classics, mathematics and music.

The boy first came into contact with the Society of Jesus when he was sent to the college of the Order at Fulda. It would appear that he showed little signs of precocious genius in his schooldays; he was more interested in sport than in study. Later, on his first application for admission to the Society of Jesus, he was to be refused on the grounds of insufficient mental ability. The "universal genius", as he came to be called in adult life, seems to have been slow in developing his talents.

Several accidents helped to sober the lively schoolboy, and gave his father the opportunity to point out to his wayward son the moral in all these occurrences. One was the near escape from drowning when Athanasius, while swimming in a forbidden pool, was swept down a mill-race and under a mill wheel; another time it was an almost miraculous escape from being trampled to death, when, having worked his way to the front of a great crowd of onlookers, he was pushed out into the path of racing horses; finally there was the severe accident, resulting in a hernia, which came from an abortive attempt to show his skill in ice skating.

These boyhood accidents made Athanasius acutely conscious of the protection of divine Providence and soon he began to think seriously of devoting his life to God in religion. His first attempt to enter the

¹ A particular example of this attitude is found in Goldsmith, M.: *The Road to Penicillin*, London, 1946, p. 53, where it is stated that "Kircher never really emancipated himself from his scholastic background; he knew too much about too many things to be absolutely objective in his observations".

² Kircher, A.: *Vita a semetipso scripta*, ed. by Langenmantel, 1684, p. 4.

Society of Jesus failed. He persisted, however in his endeavour, and finally in October, 1618, was admitted to the Novitiate at Paderborn. Fear that he would again be refused admission had made him conceal the fact that not alone was he suffering from the hernia contracted in the previous winter, but that also his legs were seriously gangrened. This he attributed to "the long hours and late nights I had spent at my studies in the same bitter winter weather"¹, trying to make sure that he would not again be turned away for lack of mental ability.

His joy at entering the Novitiate did not last long. As he says himself, "the ills from which I was suffering forced me to walk with tottering steps. My superiors immediately noticed this, and I was obliged to tell the whole story. A surgeon was called in. He was horrified at the state of my legs and pronounced me incurable I was told that since no medical attention could do me any good, I would be sent home from the Novitiate if I did not get better within a month"².

Kircher even now was a man of prayer, and pray he did with all his young fervour to the Blessed Virgin. Within a few days, not only had the hernia been cured, but his legs were perfectly sound. Kircher felt that it was a miracle; the surgeon confessed so too, and the story has come down in Jesuit tradition that Our Lady, through her ancient and much venerated statue in the church at Paderborn, had performed just one more of her miraculous cures³.

It was at the beginning of his course of philosophy in 1620 that Kircher began to show the first signs of his extraordinary mental ability. He was not given much time, however, to develop these powers, for hardly had he begun the study of physics when, in 1621, the storm of the Thirty Years War broke over Paderborn. The heretical bishop of Halberstadt swept down on Westphalia with a strong army, laying waste the countryside. The college at Paderborn was dissolved before the advance of this self-professed "supreme hater of Jesuits"; it was only with difficulty that its eighty scholastics and fathers managed to evade the bishop's troops. Ill-prepared for the journey, without food or clothing to protect them from the winter cold, Kircher and three companions set out for Cologne.

He could never forget the sufferings of that journey. Snow was deep on the roads, and in the war-devastated countryside the young Jesuits could find little food or shelter. Exhausted and hungry they finally reached the Rhine. The river was frozen over. On the advice of the local people, who took them for deserters from one of the warring armies, they began to cross the ice. It seemed quite solid but Kircher,

¹ *ibid* : p. 10.

² *ibid* : p. 11.

³ *ibid* : p. 12.

who was leading the way, suddenly saw open water before him. He turned back, but a gap had opened between him and his companions ; he was trapped on an island of ice. The river current caught the floe on which he stood and swung it out into midstream. His companions could do nothing to help : they implored God and His Blessed Mother to save him ; they watched as he was swept along, until he was out of sight ; then they crossed the river at another point and made their way to a Jesuit College on the west bank of the Rhine.

Hours later, stiff and blue and bruised and bleeding, Kircher struggled up to the door of the college. To the joy of his companions, who had been praying for the repose of his soul, he told how his ice-floe had been jammed among others down stream, permitting him to clamber along towards the further shore. He had had to swim a wide gap before he finally reached dry land.

Kircher suffered no ill effects from his terrible ordeal, and was able, after some days of rest, to proceed to Cologne, where he resumed and completed his course of philosophy.

From Cologne he went to Coblenz to begin the study of Classics, modern languages and mathematics. He was appointed professor of Greek, and was soon highly esteemed for his talent as a teacher. His great natural bent for mathematics and physics also became apparent during this period, and he began to devote himself in earnest to these subjects. In 1624 Kircher was sent to teach in the Jesuit college at Heligenstadt in Saxony. During his stay there he came to the notice of the Archbishop of Mainz through an elaborate "scenic display" which he arranged to entertain the Archbishop's legates. This "display" seems to have been some type of scientific conjuring, a show of mechanical and pyrotechnical novelties, which greatly impressed his audience. The Archbishop sent for Kircher and appointed him his mathematician and surveyor. His duties were to make maps of all the Archbishop's domains ; he carried out this work with much success, but it came to an end soon afterwards with the death of the Archbishop. Kircher was recalled by his superiors and sent to begin the study of theology at Mainz.

It was while at Mainz that Kircher made an extremely interesting and significant observation. On the twenty-fifth of April, 1625, he looked at the sun for the first time through an astronomical telescope. "As he looked at the billowing sea of flame, and saw it disturbed by flecks and spots, which now formed and now disappeared, he was filled with amazement and wonder. From that time astronomy remained his favourite study"¹. In commenting on this astounding observation he came to the conclusion that the sun was made of the same elements as was our earth, not of the unchanging quintessence of the ancients.

¹ Brischar, K. : *P. Athanasius Kircher, Ein Lebensbild*, Würzburg, 1887, p. 29.

When it is remembered that at the time the struggle between the Copernican and the Ptolemaic theories of the universe was still undecided, and that it was only nine years since the first trial and condemnation of Galileo, the significance of Kircher's conclusion is realized.

Kircher was ordained priest in 1628. By this time his talents were recognized by all : his knowledge of the classics and of modern languages was very extensive, and he had also spent several years in studying various oriental tongues. He was a skilled mathematician and physicist and, in Mainz, had made a name for himself as an experimenter. Now he was stimulated to further study in yet another branch of knowledge.

He discovered in the library of the Jesuit house at Speyer some books of illustrations of Egyptian obelisks. The hieroglyphic inscriptions on the obelisks interested him greatly : they presented a challenge which Kircher accepted. Thus began another of his life-long interests. Later, in Rome, he was to be appointed by several different Popes and Cardinals to the task of deciphering and restoring various Egyptian obelisks. It appears that he acquitted himself of these charges much to the satisfaction of his contemporaries. Modern Egyptologists have not the same respect for Kircher's attempts at hieroglyphic interpretation. In fact, until the discovery of the Rosetta stone in 1779, all such attempts were foredoomed to failure, since it was believed that the hieroglyphics were ideographs, while in fact they were alphabetical.

From Speyer Kircher was sent to Würzburg where he was to teach two very unrelated subjects, mathematics and the Syrian language. Here, too, he began to write his scientific treatise, "*Ars Magnesia : Experimentalis physico-mathematica de natura, viribus, et prodigiosis effectibus magnetis*", a study of magnetism, published in 1629. This book was the first of a long series of works on natural science which Kircher was to produce in the next half century.

The Thirty Years war was still devastating Germany. In October, 1630, a sudden attack by the Swedish army under Gustavus Adolphus took Franconia by surprise, and soon the enemy were marching on Würzburg. The Jesuit college was closed and its members scattered. With considerable difficulty Kircher made his way to Mainz and thence back to Speyer. But not even here could he find peace for his studies. Finally he was forced to leave his fatherland and go into exile in France. After a short stay in Paris, Kircher moved on to Avignon where he taught mathematics and oriental languages in the Jesuit College.

He now had the good fortune to meet Nicholas Claude Fabri de Peiresc, a brilliant scholar and patron of learning, who shared his interest in oriental languages and Egyptian hieroglyphics. De Peiresc opened his library and gave every other assistance he could to the Jesuit. It seemed that at last Kircher had found a haven in which to pursue his studies. However, his superiors directed him to set out for Vienna,

where the Emperor had personally asked to have him appointed mathematician. "When de Peiresc heard of this", records Kircher, "he left no stone unturned to prevent my going. He was afraid that if I were occupied with mathematical studies at the Court of Vienna, I would neglect my studies on hieroglyphics. He sent urgent letters to Rome, both to the Pope, Urban VIII, and to his friend Cardinal Barberrini, begging them to forbid me to go to Austria, and to call me to Rome instead"¹. Before de Peiresc received a reply from Rome, Kircher was already on the road for Vienna.

To avoid the dangers of war-torn Germany he decided to travel by sea to Genoa. From there he would go overland through northern Italy to Austria. But Providence had other plans for him. The little coastal vessel on which he embarked at Marseilles made little headway because of contrary winds. After sheltering in the lee of an island for some days, the captain lost patience. Disregarding the still unsettled weather he decided to put to sea. To the sea-sick landlubber, Kircher, this resolve must have seemed foolhardy, especially as the storm continued to increase in fury. "The wind howled from the south", he records, "and the sea arose in mountainous waves. However, with courage that inspired all, the captain held to his course. But soon we were reduced to terrible straits and the ship was no longer able to resist the violence of the waves. These were so terrible that you could not look on them without being filled with fear. We did our best to keep on bailing out the water as it poured into the ship. All were desperate, and tried to gain Divine help by going to confession and making vows to the Blessed Virgin"².

Darkness fell ; not even the moon gave its light ; but the pilot kept his head. He remembered that there was a cavern on the nearby coast, which opened on to the sea, and hoped that it might give them shelter if he were able to get the vessel through the narrow entrance.

"Completely ignorant of the dangerous resolve of the pilot, we approached the cavern. Every now and again the waves would roll up and cover its entrance and then recede and expose it once more. Coolly, and certainly with the help of his guardian angel, the pilot watched the waves roll back. Then swiftly he turned the vessel and was swept by the force of the next wave right into the cavern. It was more by the help of God, than by the skill of man, that he managed this feat, for otherwise the ship would have been swamped at the entrance and we would all have been smashed to death on the rocks"³.

After further adventures the weary travellers finally reached the port of Civita Vecchia. Here, to his great surprise, Kircher found

¹ Kircher, A. : *Vita*, p. 29.

² *ibid* : p. 30.

³ *ibid* : p. 31.

letters awaiting him with orders to abandon his Austrian journey and proceed to Rome. De Peiresc had succeeded in his endeavour and Kircher's appointment as Court Mathematician at Vienna had been cancelled. At the command of the Pope he was to devote himself to the study of ancient languages and of natural science in "the City".

The Roman College of the Society of Jesus which opened its doors to Kircher in early 1634 had been in existence for more than eighty years. Founded through the generosity of the Duke of Gandia, Saint Francis Borgia, the college had already made a name for itself in the world of learning. It has continued its honourable and successful history to the present day, and is now known as the Gregorian University of Rome.

Kircher's duties at the Roman College were to lecture in natural history and to carry out researches on the interpretation of hieroglyphics and on problems of mathematics. Within a few years he was freed by order of the Pope, from his lecturing post, so that he might have leisure to apply himself fully to his scientific research.

Kircher lived in Rome for the remainder of his life, except for two years spent in Malta as Confessor to the Papal legate. His return journey from Malta through Southern Italy coincided with a period of violent earthquakes and volcanic activity in the region. Stromboli and Vesuvius poured molten lava and ash on the surrounding countryside. Though Kircher was little prepared by his own solid fatherland for such phenomena of nature, and had been shaken by a narrow escape from death during one eruption, he made full use of his opportunity for 'on the spot' scientific observations. He spent some time studying the cause and effects of volcanoes. His interest even led him to have himself lowered on the end of a rope into the now quiet but still smoking crater of Vesuvius, to see for himself what this outlet of subterranean fire might be like. As a result of these investigations he wrote *Mundus Subterraneus*¹.

Mundus Subterraneus deals with everything that is to be found under the earth, with volcanoes, earthquakes, underground rivers and lakes, minerals and underground animals, plants, and even, underground men. It is an enormous work, divided into twelve "books", containing not only the results of Kircher's own investigations, but also all the information he was able to collect from ancient and modern authors. It is extremely well illustrated, some of the beautiful engravings showing techniques of mining and metallurgical operations. The eleventh book, *De Alchemia* is of particular interest and deserves special attention here.

Kircher justifies the inclusion of a section on alchemy in *Mundus Subterraneus* on the grounds that all alchemy, even the pseudo-science

¹ Kircher, A.: *Mundus Subterraneus*. Quotations are from the third ed. published in Amsterdam, 1678.

of the seekers of the Philosophers' Stone, is derived from the ancient and honourable science of metallurgy, a science which draws its material from underground. In fact, he says, metallurgy is the "prima alchemia" while the two other branches, "alchemia transmutatoria" and "chymia spagyrica" or "chemistria" are later developments of the "alchemia metallurgica"¹.

The most important point about this book is that it was published in 1665, four years after Robert Boyle had given to the world his revolutionary *Sceptical Chymist*. Boyle's intention was to stop "learned men" from taking all the ancient teaching on chemistry for granted; to show that certain of the traditional doctrines of qualities and principles were unsound, to lead chemists to investigate and make experiments for themselves, and thus to put chemistry on a sound scientific footing. He criticized the Aristotelian teachings on the four elements and the three principles, and questioned whether salt, sulphur and mercury were the real basis of all other substances. By his scepticism Boyle put chemistry on the road to its present-day high status².

Kircher held firmly to the Aristotelian doctrines, but this did not make him less a "modern" than was Boyle. His purpose, he said, was "to separate truth from falsehood, the licit from the illicit, the honest from the fraudulent . . . so that learned men, both physicians and philosophers, when they have examined these matters and experiments, may, along with me, be able to discern truth from falsehood"³. By descriptions of his own skilful experiments and by examination and criticism of the writings of others, Kircher builds up an excellent picture of the state of chemistry in his day. A detailed examination of his work would be out of place here. Suffice it to say that Kircher could share with Boyle, not alone the title "sceptical chymist", but also that of "father of modern science".

A brief account of some of Kircher's other books will give an idea of his vast erudition and of the breadth of his interests. In 1638 he published in Rome a second treatise on magnetism. Several books on eastern languages, on archaeology and on Egyptian hieroglyphics appeared in the following years. The most famous of these, *Oedipus Aegyptiacus* (1652) embodies the results of twenty years of research on hieroglyphics. His work on music, *Musurgia Universalis* was published in Rome in 1650 and in Amsterdam in 1662. As well as dealing with the theory of sound and acoustics, the book contains selections from the works of little-known seventeenth century musicians. Here also Kircher describes a mathematical method of learning music—a method which Robert Hooke was to criticize in a letter to Boyle some years

¹ Kircher, A.: *Mundus Subterraneus*, p. 250 and 251.

² Boyle, R.: *The Sceptical Chymist, Works*, Vol. I, p. 459ff.

³ Kircher, A.: *Mundus Subterraneus*, p. 249.

later¹. A book on light and shadow was also published at Rome and Amsterdam. It contains an interesting description, as well as illustrations, of an early type of "magic lantern" built by Kircher.

In *Arca Noë*, a book on animals of the time of the Great Deluge, Kircher expressed his belief that our modern species had developed by transmutation within definite series of forms. Biologists of later centuries commented on this remarkably progressive view on the evolution of species².

In 1656 bubonic plague, which had already ravaged Southern Italy, reached Rome. Thousands fled from the city to avoid the contagion. Of those who remained fifteen thousand perished, despite the efforts of the health authorities, directed by the Pope in person³. The Jesuits and the other religious of Rome laboured unceasingly to help the plague victims. Kircher applied his scientific skill to finding some remedy for the disease. With the assistance of the doctors of Rome he examined numbers of patients, suggesting cures and treatments. Moreover, using the primitive microscopes at his disposal, he examined blood samples from infected persons. He came to the conclusion that "the carriers of plague are tiny worms (vermiculi), so small, fine and subtile, that they can only be recognized through a very good microscope"⁴. He suggested that the plague was spread by contact between persons, or by cats and dogs and even by flies and other insects. Kircher published the results of these investigations in a book entitled *Scrutinium Physico-medicum contagiosae Luis, quae Pestis dicitur* (Rome, 1658).

It is true that what Kircher saw through his microscope may have been blood corpuscles or even insect larvae, and not bacteria, but his book nevertheless contains an excellent résumé of all that was then known of the plague. Moreover its sections on the spread of the disease were most valuable and far in advance of much that had been written on the subject until that time.

Among other works published by Kircher in these years is one which reveals a further interest of this universal scholar. This is *China Monumentis Illustrata*, in which he edited the notes of several great Jesuit missionaries, including those of Fathers Roth and Grueber. Father Grueber's account of his overland journey from Peking to Smyrna, "the greatest missionary journey in the history of the Jesuit missions"⁵, is given in part, as well as a Sanskrit grammar compiled by Fr Roth,

¹ Hooke, R. : Letter to Boyle in *Works*, Vol. VI, p. 495.

² Kircher, A. : *Arca Noë*, Amsterdam, 1667, p. 196. See also, Wasmann, E. : *Modern Biology and the Theory of Evolution*, London, 1923, p. 276.

³ Pastor, L. : *The History of the Popes*, Vol. XXXVI, c. 1.

⁴ Kircher, A. : *Scrutinium*, pubd. in Rome, 1658, cf. p. 141.

⁵ Plattner, F. : *Jesuits go East*, Dublin, 1950, p. 187.

the first to be published in Europe. Kircher's book created a great stir among scholars and was soon translated into many languages¹.

Reference has already been made to the interest displayed by Robert Boyle in Kircher's studies. In later life, through friends visiting Rome, Boyle established contact with Kircher and sent him enquiries and greetings². He became a correspondent of one of Kircher's former assistants, Fr Kaspar Schott, S.J., who was at the time professor of physics at Augsburg. With Boyle's permission Schott incorporated one of the English scientist's pneumatical works into a treatise on mechanics, which also contained a section by Kircher³.

Kircher's contacts with the Royal Society in London were twofold: extracts as well as reviews of some of his works were published in the early numbers of the *Philosophical Transactions* of the Society⁴. Some years later he had a controversy with the Society with regard to the priority of invention of some peculiar instruments. Samuel Moreland, F.R.S., had demonstrated before the Society a type of speaking-tube or megaphone, and had been acclaimed in the *Transactions* as the inventor of the instrument⁵. Kircher maintained that he had published an account of this very instrument some twenty years before Moreland's demonstration. His claim, backed up by the testimonies of many other scientists, was printed in a book entitled *Phonurgia Nova*, which was an amplification of his earlier work *Musurgia Universalis*⁶.

In his fifty years at Rome Kircher produced about forty books on scientific matters, as well as a number of papers and smaller works on a variety of non-scientific subjects. He also founded a museum which was reckoned one of the great scientific museums of the world until its dispersion in 1870⁷. His ceaseless investigations, his many commissions from Popes, prelates and princes won him the titles of "universal genius" and "master of an hundred arts".

But there is another facet of his character which has not yet been discussed. Kircher was a zealous priest, eager to spread the Kingdom

¹ It was translated into English by a certain John Ogilby and was reproduced in part in Nieuhof, J.: *An Embassy of the East India Company . . . to the Emperor of China . .*, London, 1669. Russian, French and Dutch translations were also published.

² Southwell, R.: Letter to Robert Boyle in *Works*, Vol. VI, p. 299.

³ Schottus, K.: *Mechanica Hydraulica-pneumatica*, Leipzig, 1657. Boyle, R.: Minutes of a letter to Schottus in *Works*, Vol. VI, p. 299.

⁴ *Philosophical Transactions of the Royal Society (London)*, Vol. I, 40, 1665, contains a translation of an extract from *Mundus Subterraneus* entitled *An Experiment of a Way of Preparing a liquor that shall sink into and colour the whole body of Marble . .* In the same volume is a review of *Mundus Subterraneus* itself. Volume II (1667), p. 484, has a review of *China Monumentis Illustrata* and volume IV (1669), p. 1093, a review of Kircher's book *Ars Magna Sciendi* which was published in Amsterdam in 1669.

⁵ *Phil. Trans. Roy. Soc. (Lond.)*, 1672, VI, 3056.

⁶ Kircher, A.: *Phonurgia Nova*, Rome, 1673.

⁷ Murray towards the end of the last century described the Kircherian Museum of the Roman College as "one of the great museums of the world". *Museums—their History and Uses*, Glasgow, 1904, p. 106.

of Christ in Europe and in missionary lands. At one time he had hoped to spend his life on the Chinese mission, using his scientific skill as Ricci and Schall had done, as a passport to the "Forbidden Empire". His superiors had decided that he would serve God better by dedicating himself to study at home and Kircher humbly accepted that decision.

Towards the end of his life he had the opportunity of exercising his apostolic zeal in a manner, not as spectacular, but yet in the same spirit, as his brethren in missionary lands. During an archaeological field-trip he discovered an ancient shrine of Our Lady in the Sabine Hills near Rome. This shrine of Our Lady of Mentorella had originally been erected by order of the Emperor Constantine the Great in the fourth century, but after great initial devotion it had been forgotten by people. By the seventeenth century it was neglected and crumbling into ruins. With the financial help of his patrons and with the blessing of the Pope, Kircher had the church renovated and its ancient statue of Our Lady restored and decorated. Soon crowds were again flocking to the shrine. Kircher devoted much of his later years to the service of the shrine, frequently saying Mass there, organizing pilgrimages, hearing confessions, and preaching. To-day the shrine still stands as a memorial to Kircher the priest.

At the age of seventy-nine, on 28 November 1680, Athanasius Kircher died at Rome. The Pope, Princes of the Church and State, scholars, the people who had grown to love him at Mentorella and his brethren in many lands lamented the passing of this great man. At his special request his heart was buried at the foot of the statue of Our Lady of Mentorella, as a sign of the spirit of devotion and love and dedication which had animated his years of study.

The life of Athanasius Kircher brings out clearly two important points. It exemplifies the labours and achievements of the Jesuit scientists of the seventeenth century, and justifies their inclusion among the pioneers of modern science. It also shows that scholars of the Catholic Church, even in the days of Galileo, were ready to join in the new, progressive movement which was to release physical science from its over-close connection with philosophy, and lead it, an independent, empirical discipline, to its present-day position. Kircher saw clearly the distinction between natural science and philosophy. His investigations were experimental and objective in the best traditions of modern science, and, unlike those of many of his contemporaries, were not smothered in a confusion of philosophical terms. He was a traditionalist; yet his achievements in the modern sciences are undeniable. He was a man whose mind was not only imbued with the spirit and learning of the past, but was ever open to the developments and possibilities of the future.